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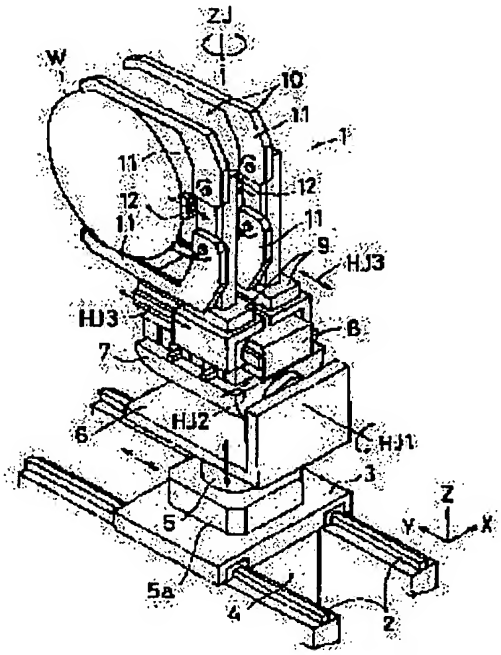
(54) WAFER CONVEYER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a wafer conveyer which reduces adverse influence on a wafer at transferring the wafer.

SOLUTION: A water transfer arm 10 is capable of holding a wafer W in the standing and lying attitudes and moving to and from an arm support base 8 to thereby transfer wafers W to/from a wafer processor. A semicircular column 7 is rotated round an axis HJ1, relative to a second stage 6 to change the hold arm 10 to the standing or laying attitude. The arm 10 is movable in a horizontal direction along a rail 2 or vertically to move between wafer processors. This conveyer 1 holds the wafer W being standing and moves them at least between the wafer processors.



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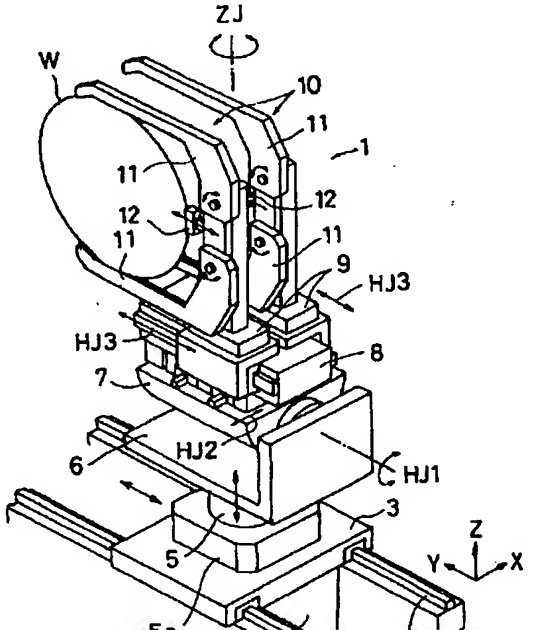
(54)【発明の名称】　基板搬送装置

(57)【要約】
【課題】　基板搬送時の基板への悪影響を軽減し得る基板搬送装置を提供する。
【解決手段】　基板搬送アーム１０は基板Ｗを起立姿勢状態および水平姿勢状態で保持し得るように構成されている。基板保持アーム１０はアーム支持台８に対して出退自在に構成され、基板処理部に対する基板Ｗの受渡しが行える。第２の台座６に対して半円柱状部材７をＨＪ１軸周りに回転させることで、基板保持アーム１０は起立姿勢と水平姿勢とで姿勢転換される。基板保持アーム１０はレール２に沿った水平１軸方向の移動や昇降などが可能に構成され、基板処理部間の移動が行える。この基板搬送装置１は、少なくとも各基板処理部間の移動を、基板Ｗを起立姿勢状態に保持して行う。



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【特許請求の範囲】

【請求項１】　複数の基板処理部を有する基板処理装置内に備えられ、基板を保持して各基板処理部間で移動するとともに、各基板処理部に対する基板の受渡しを行う基板搬送装置において、

基板を起立姿勢状態および水平姿勢状態で保持し得る基板保持アームと、

前記基板保持アームを起立姿勢と水平姿勢とで姿勢転換させる姿勢転換手段と、

前記基板保持アームを介して各基板処理部に対する基板の受渡しを行う基板受渡し手段と、

前記基板保持アームを各基板処理部間で移動させる移動手段と、

を備え、少なくとも各基板処理部間の移動を、基板を起立姿勢状態に保持して行うことを特徴とする基板搬送装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、複数の基板処理部を有する基板処理装置内に備えられ、基板を保持して各基板処理部間で移動するとともに、各基板処理部に対する基板の受渡しを行う基板搬送装置に関する。

【０００２】

【従来の技術】この種の基板搬送装置は、例えば、熱処理部（加熱処理部や冷却処理部）、スピンコーター、スピンデベロッパーなどの複数の基板処理部を有する基板処理装置（レジスト処理装置など）に備えられ、所定の基板処理手順に従って、基板を保持して各基板処理部間で移動するとともに、各基板処理部に対する基板の受渡しを行うように構成されている。

【０００３】従来の基板搬送装置は、基板処理装置内での基板の搬送（各基板処理部間の移動や各基板処理部に対する基板の受渡しなど）を基板を水平姿勢に保持して行っている。

【０００４】

【発明が解決しようとする課題】しかしながら、このような構成を有する従来例の場合には、次のような問題がある。この種の基板処理装置においては、基板搬送装置が基板を搬送する基板搬送路などには、パーティクルの舞い上がりなどを抑制するために、装置上方から装置下方へとダウンフローの気流を流している。しかしながら、基板の搬送を、基板を水平姿勢に保持して行えば、基板の上面（通常は処理面）にダウンフローの気流が直接当たることになる。そのため、ダウンフローの気流とともに流下されるパーティクルが基板の処理面に付着し易いという問題があった。

【０００５】また、上記ダウンフローの気流とともに流下される熱雰囲気により基板の処理面に熱的影響を与え

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保持して行えば、上記ダウンフローの気流の流れを阻害する要因にもなっていた。

【０００７】本発明は、このような事情に鑑みてなされたものであって、基板搬送時の基板への悪影響などを軽減し得る基板搬送装置を提供することを目的とする。

【０００８】

【課題を解決するための手段】本発明は、このような目的を達成するために、次のような構成をとる。すなわち、本発明は、複数の基板処理部を有する基板処理装置内に備えられ、基板を保持して各基板処理部間で移動するとともに、各基板処理部に対する基板の受渡しを行う基板搬送装置において、基板を起立姿勢状態および水平姿勢状態で保持し得る基板保持アームと、前記基板保持アームを起立姿勢と水平姿勢とで姿勢転換させる姿勢転換手段と、前記基板保持アームを介して各基板処理部に対する基板の受渡しを行う基板受渡し手段と、前記基板保持アームを各基板処理部間で移動させる移動手段と、を備え、少なくとも各基板処理部間の移動を、基板を起立姿勢状態に保持して行うことを特徴とするものである。

【０００９】

【作用】本発明の作用は次のとおりである。基板搬送中、基板は基板保持アームに保持される。そして、基板保持アームが起立姿勢に姿勢転換され、保持されている基板を起立姿勢状態にする。この状態で移動手段によって基板保持アームが移動され、各基板処理部間の基板の移動が行われる。すなわち、基板は起立姿勢状態に保持されて、各基板処理部間で移動される。

【００１０】また、基板受渡し手段によって基板保持手段に保持された基板と基板処理部との間の基板の受渡しが行われるが、基板を水平姿勢で基板処理する基板処理部に対する基板の受渡しは、姿勢転換手段により基板保持アームを水平姿勢に姿勢転換して行う。また、基板を起立姿勢で基板処理する基板処理部に対する基板の受渡しは、基板の移動時のまま、基板保持アームを起立姿勢にした状態で行う。

【００１１】なお、基板の起立姿勢とは基板の処理面が鉛直軸方向に平行となる姿勢をいい、基板の水平姿勢とは基板の処理面が水平方向に平行となる姿勢をいう。また、基板保持アームの起立姿勢とは基板を起立姿勢状態で保持する姿勢をいい、基板保持アームの水平姿勢とは基板を水平姿勢状態で保持する姿勢をいう。

【００１２】

【発明の実施の形態】以下、図面を参照して本発明の実施の形態を説明する。図１は、本発明の一実施例に係る基板搬送装置の構成を示す斜視図であり、図２は、基板保持アームによる基板の保持状態と非保持状態とを示す要部側面図、図３は、基板保持アームが起立姿勢と水平

適宜の図面にはＸＹＺ直交座標系を付している。また、このＸＹＺ直交座標系では、Ｘ軸、Ｙ軸が水平方向の直交軸（ＸＹ平面が水平面）であり、Ｚ軸が鉛直軸である。

【００１３】この基板搬送装置１は、以下のように構成されている。水平１軸方向である図のＹ軸（Ｘ軸でもよい）方向に配設された一対のレール２に沿って第１の台座３が水平１軸方向（図ではＹ軸方向）に移動されるように構成されている。

【００１４】第１の台座３の下部には旋回昇降機構４が取り付けられている。旋回昇降機構４は第１の台座３とともにレール２に沿って移動される。この旋回昇降機構４により、第１の台座３を貫通した昇降部５ａが昇降（第１の台座３から出退）されるとともに、昇降部５ａから回転自在に突出された軸５が鉛直軸である図のＺＪ軸（なお、ＺＪ軸は軸５の中心軸に一致する軸である）周りに回転（旋回）されるようになっている。なお、旋回昇降機構４は、昇降部５ａに内設された図示しないモーターの回転により軸５を旋回させ、その昇降部５ａを、ボールネジなどの周知の１軸方向駆動機構（図示せず）によって昇降させるように構成されている。

【００１５】軸５の上端部には第２の台座６が取り付けられている。この第２の台座６には、半円柱状の部材７が図示しないモーターによって水平１軸（図のＨＪ１軸）周りに回転されるように取り付けられている。この半円柱状部材７には、アーム支持台８が前記ＨＪ１軸に直交する水平１軸（図のＨＪ２軸）方向に微小移動できるように取り付けられている。

【００１６】アーム支持台８には、２個のアーム支持部９が前記ＨＪ１軸に平行な水平１軸（図のＨＪ３軸）方向に個別に移動（アーム支持台８に対して出退）されるようになっている。

【００１７】各アーム支持部９には基板保持アーム１０が設けられている。各基板保持アーム１０は、開閉自在に構成された一対のアーム部材１１と、出退自在に構成された基板保持部１２とを備えている。各アーム部材１１と基板保持部１２には、図示しない溝が刻設されていて、各アーム部材１１が閉じられるとともに、基板保持部１２が突出された状態で基板Ｗが前記各アーム部材１１及び基板保持部１２の溝に保持されるようになっている（図２（ａ））。一方、各アーム部材１１が開かれるとともに、基板保持部１２が後退された状態で基板Ｗの保持状態が解除されるようになっている（図２（ｂ））。

【００１８】第１の台座３がレール２に沿って移動されることにより、基板保持アーム１０が水平１軸（Ｙ軸）方向に移動される。また、第１の台座３に対して昇降部５ａが昇降されることにより基板保持アーム１０が昇降する方向が変えられる。これら動作により、基板保持アーム１０が、基板処理装置に設置される複数の基板処理部間で移動される。

【００１９】また、第２の台座６に対して半円柱状部材７がＨＪ１軸周りに回転されることにより、基板保持アーム１０が起立姿勢（基板Ｗを起立姿勢状態で保持する姿勢）と、水平姿勢（基板Ｗを水平姿勢状態で保持する姿勢）との間で姿勢転換される（図１、図３参照）。

【００２０】さらに、アーム保持台８に対する基板保持アーム１０の出退動作と、半円柱状部材７に対するアーム支持台８のＨＪ２軸方向の微小移動と、基板保持アーム１０による基板Ｗの保持およびその解除の動作とにより、各基板処理部に対する基板Ｗの受渡しが行われる。

【００２１】この基板搬送装置１は、基板処理部間の移動を基板保持アーム１０を起立姿勢にし、基板Ｗを起立姿勢状態に保持して行う。

【００２２】また、この基板搬送装置１が備えられる基板処理装置に設置される各基板処理部での基板処理は、従来一般に、基板Ｗを水平姿勢に保持して行われるが、この基板搬送装置１によれば、基板Ｗを水平姿勢に保持して基板処理する基板処理部に対する基板Ｗの受渡しは、基板保持アーム１０の起立姿勢と水平姿勢との姿勢転換を行って、基板保持アーム１０を水平姿勢にして行うことができる。

【００２３】また、基板Ｗを起立姿勢に保持して基板処理する基板処理部に対する基板Ｗの受渡しは、基板Ｗの移動時のまま基板保持アーム１０を起立姿勢にして行うことができる。

【００２４】この種の基板処理装置の基板搬送路（基板搬送装置１が基板Ｗの搬送などを行う通路部分）などには、装置上方から装置下方へとダウンフローで気流を流して、基板搬送路などにおけるパーティクルの舞い上がりなどを抑制するようにしている。

【００２５】例えば、従来装置のように、基板搬送路における基板Ｗの移動などを基板Ｗを水平姿勢にして行うと、図４（ａ）に示すように、基板の上面（通常、処理面を上面にして基板搬送される）に、矢印で示すダウンフローの気流とともに流下されてくるパーティクルが付着し易くなる。また、加熱処理部から基板搬送路の上方に放出される熱雰囲気がダウンフローの気流とともに下降してくると、上記パーティクルの付着と同様に、その熱雰囲気を水平姿勢の基板Ｗの上面（処理面）で受け止めることになるので、基板Ｗの処理面への熱的影響を受け易い。さらに、基板Ｗが水平姿勢であれば、ダウンフローの気流を基板Ｗの上面で受け止めることになるので、ダウンフローの気流の妨げにもなる（図４（ａ）参照）。

【００２６】これに対して、本発明に係る基板搬送装置

基板Ｗの処理面へのパーティクルの付着が起き難く、熱的影響も受け難くなる。さらに、基板Ｗが起立姿勢であると、ダウンフローの気流の妨げにもなり難い（図４（ｂ）参照）。

【００２７】また、図５に示すように、基板搬送路において基板Ｗの移動などを行う際、従来のように基板Ｗを水平姿勢にして行う場合（図５（ａ））と、本発明のように起立姿勢にして行う場合（図５（ｂ））とでは、平面視で見て起立姿勢で行う方が基板Ｗの投影面積が小さくなる。従って、基板Ｗを起立姿勢にして基板Ｗの移動などを行うことにより、基板搬送路の水平方向の面積のコンパクト化を図ることも可能となり、基板処理装置の設置面積のコンパクト化を図ることも可能になる。

【００２８】ところで、上述したように、基板処理装置内の基板処理部は、従来一般に、基板Ｗを水平姿勢に保持して基板処理するように構成されている。例えば、基板処理装置の一つであるレジスト処理装置に設置される基板処理部の一つである熱処理部（加熱処理部、冷却処理部）は、従来、図６、図７に示すように構成されている。

【００２９】すなわち、従来の熱処理部２０ｐは、熱プレート（加熱処理部では加熱プレート、冷却処理部では冷却プレート）２３の熱処理面２２が、水平方向に一致するように熱プレート２３が配設されている。そして、基板Ｗは、熱処理面２２に接触載置されたり、微小間隔（プロキシミティギャップ）を隔てて近接支持されて熱処理が施される。つまり、基板Ｗは水平姿勢で熱処理が施される。

【００３０】なお、従来の熱処理部２０ｐでの基板Ｗの受渡しは、一般的に、熱プレート２３を貫通して昇降自在に設けられた複数本の昇降ピンＺＰを用いて行われるように構成されている。すなわち、図の二点鎖線で示すように、複数本の昇降ピンＺＰが熱プレート２３から突出して基板Ｗが熱プレート２３上方に支持された受渡し位置で基板Ｗの受渡しが行われる。

【００３１】従来の基板搬送装置は、基板Ｗを水平姿勢に保持して移動などを行っているが、上記実施例に係る基板搬送装置１は、基板Ｗ（基板保持アーム１０）を起立姿勢に保持して移動などを行うようにしている。そのため、図６、図７に示す熱処理部２０ｐに対する基板Ｗの受渡しでは、従来の基板搬送装置による基板Ｗの受渡し動作に加えて、基板保持アーム１０を起立姿勢と水平姿勢との間で姿勢転換する動作が必要になる。

【００３２】例えば、基板搬送装置１の基板保持アーム１０に保持された基板Ｗを昇降ピンＺＰに引き渡す場合には、起立姿勢の基板保持アーム１０を水平姿勢に姿勢転換する。そして、アーム保持台８に対して基板保持アーム１０を送り出し、基板Ｗを水平姿勢状態で熱プレー

１０を後退させて水平姿勢の基板保持アーム１０を起立姿勢に姿勢転換する。

【００３３】また、基板搬送装置１の基板保持アーム１０が昇降ピンＺＰから基板Ｗを受け取る場合には、起立姿勢の基板保持アーム１０を水平姿勢に姿勢転換し、アーム保持台８に対して基板保持アーム１０を送り出し、熱プレート２３上方の受渡し位置で水平姿勢の基板保持アーム１０が昇降ピンＺＰから水平姿勢の基板Ｗを受け取る。そして、基板Ｗを保持した基板保持アーム１０を後退させて水平姿勢の基板保持アーム１０を起立姿勢に姿勢転換する。

【００３４】なお、その他の基板処理部であるスピンコーターやスピンデベロッパーなどでは、スピンチャックに基板Ｗを水平姿勢で保持してレジスト塗布処理や現像処理などが行われるが、このスピンチャックと基板保持アーム１０との間の基板Ｗの受渡しも、上記熱処理部２０ｐと同様に、基板保持アーム１０を水平姿勢にした状態で行われる。

【００３５】ここで、基板処理部での基板処理を基板Ｗを起立姿勢で保持して行うように構成すれば、基板保持アーム１０を起立姿勢にした状態で基板Ｗの受渡しが行える。

【００３６】例えば、熱処理部を図８ないし図１１に示すように構成すれば、基板保持アーム１０を起立姿勢にした状態で基板Ｗの受渡しが行える。

【００３７】図８は、改良された熱処理部の概略構成を示す正面図であり、図９は、図８のＡ－Ａ矢視図、図１０は、基板保持部材の構成を示す一部省略断面図であって、図９のＢ－Ｂ矢視断面図、図１１は、基板保持部材の開閉機構の一例の構成を示す図である。

【００３８】この熱処理部２０は、基板Ｗを起立姿勢で保持する基板保持台２１と、基板保持台２１に保持された基板Ｗに対向する熱処理面２２を有する熱プレート２３とを備えて構成されている。

【００３９】基板保持台２１には、基板Ｗの外周端部の少なくとも３箇所以上（図では４箇所）を保持するための３個以上（図では４個）の基板保持部材２４が設けられている。各基板保持部材２４は、長孔２５に沿って図の矢印に示す方向に開閉するようになっていて、基板Ｗの外周端部に接触して基板Ｗを保持する保持状態と、基板Ｗの外周端部から離れて基板Ｗの保持を解除する非保持状態とを採り得るように構成されている。なお、各基板保持部材２４には切り欠き２４ａが設けられていて、上記保持状態のとき、この切り欠き２４ａで基板Ｗを保持するようになっている（図１０参照）。

【００４０】各基板保持部材２４を開閉させる開閉機構は、例えば、図１１に示すリンク機構２６などのような機構で実現することができる。図１１の機構では、円板

支持されている。各基板保持部材２４と円板状部材２６ａとがアーム部材２６ｂによって連結されている。各アーム部材２６ｂの一端部側は、各基板保持部材２４の基端部に回動自在に連結され、他端部側は、円板状部材２６ａの外周端部に回動自在に連結されている。そして、図示しないエアシリンダなどによって駆動されて円板状部材２６ａがＣＪ軸周りに所定角度回動されることで、各アーム部材２６ｂが図の実線と二点鎖線の間で変位し、各基板保持部材２４は長孔２５に沿って開閉される。

【００４１】また、基板保持台２１は、モーター２７によってＣＪ軸周りに回転されるようになっている。上記ＣＪ軸は、基板保持台２１に保持された基板Ｗの中心を貫通する軸であり、上記基板保持台２１のＣＪ軸周りの回転により、基板保持台２１に保持された基板Ｗが中心周りに回転されるようになっている。

【００４２】なお、例えば、基板Ｗを起立姿勢で加熱処理すると、基板の熱履歴が鉛直軸方向に変動する可能性があるので、そのような不都合を防止するために基板Ｗを中心周りに回転させるようにしているが、基板Ｗの鉛直軸方向の熱履歴の変動が心配ない場合には、モーター２７などを省略してもよい。

【００４３】熱処理部２０が加熱処理部である場合には、熱プレート（加熱プレート）２３には図示しないヒーターなどが内設されて熱処理面２２を加熱して、基板保持台２１に保持された基板Ｗに加熱処理を施すように構成される。また、熱処理部２０が冷却処理部である場合には、熱プレート（冷却プレート）２３には図示しないペルチェ素子などが内設されて熱処理面２２を冷却して、基板保持台２１に保持された基板Ｗに冷却処理を施すように構成される。この熱プレート２３は、基板保持台２１に保持された基板Ｗに熱処理面２２が対向するように起立姿勢で配設されている。

【００４４】なお、基板搬送装置１との基板Ｗの受渡しを行い易くするために、ボールネジやエアシリンダなどの周知の１軸方向駆動機構（図示せず）により、基板保持台２１と熱プレート２３とは相対的に接離されるように構成されている。そして、基板Ｗの受渡し時には、基板保持台２１と熱プレート２３とが相対的に離間され、熱処理時には、基板保持台２１と熱プレート２３とが相対的に近接されるようになっている。

【００４５】次に、この熱処理部２０の基板保持台２１と基板搬送装置１の基板保持アーム１０との間の基板Ｗの受渡しについて説明する。

【００４６】基板保持アーム１０が保持している基板Ｗを基板保持台２１に引き渡す場合について図１２を参照して説明する。

【００４７】レール２に沿った移動や昇降動作により、基板保持アーム１０の出退方向を熱処理部２０側に調節する。そして、起立姿勢の基板保持アーム１０をアーム保持台８に対して送り出す（図１２（ａ））。

【００４８】次に、アーム支持台８をＨＪ２軸方向（図の右方向）に微小移動させて、基板保持台２１の基板保持部材２４が基板Ｗを保持し得る位置に基板Ｗを位置させる（図１２（ｂ））。このとき、基板保持台２１の基板保持部材２４は開いている。そして、上記動作によって基板保持部材２４が基板Ｗを保持し得る位置に基板Ｗが位置されると、基板保持部材２４を閉じて基板保持台２１側でも基板Ｗを保持する（図１２（ｃ））。

【００４９】そして、基板保持アーム１０による基板Ｗの保持を解除させ、アーム支持台８をＨＪ２軸方向（図の左方向）に微小移動させて基板保持アーム１０と基板保持部材２４との干渉を避ける状態にし、アーム部材１１を閉じてから、基板保持アーム１０を後退させる（図１２（ｄ））。これにより、基板保持アーム１０が起立姿勢のまま基板保持アーム１０から基板Ｗを基板保持台２１に引き渡すことができる。

【００５０】熱処理部２０では、基板Ｗを受け取ると、基板Ｗを保持した基板保持台２１と熱プレート２３とが相対的に接近し、基板Ｗと熱処理面２２とを近接配置させて基板Ｗに熱処理を施す。このとき、基板Ｗの鉛直軸方向の熱履歴が変動する場合には、基板保持台２１をＣＪ軸周りに回転させ、熱処理面２２に対して基板Ｗを中心周りに回転させて熱処理を行う（図１２（ｅ））。

【００５１】また、基板保持台２１に保持されている基板Ｗを基板保持アーム１０で取り出す場合は、上記動作と略逆の動作で行うことができる。

【００５２】このように、基板Ｗを起立姿勢に保持して基板処理するように基板処理部を構成することで、基板保持アーム１０を起立姿勢にしたまま基板保持アーム１０と基板処理部との間の基板Ｗの受渡しを行うことができ、起立姿勢の基板保持アーム１０を水平姿勢に姿勢転換したり、水平姿勢の基板保持アーム１０を起立姿勢に姿勢転換する動作が不要となる。また、基板Ｗの受渡しも、基板Ｗを起立姿勢状態に保持して行うので、基板Ｗの受渡し時においても、基板Ｗの処理面へのパーティクルの付着や熱的影響などを軽減することができる。

【００５３】ところで、一般的に、熱プレート２３の熱処理面２２は、その直径が基板Ｗの直径よりも大きくなるように構成されている。従って、従来の熱処理部２０ｐでは、基板Ｗを水平姿勢にして熱処理する構成であるので、熱処理面２２（熱プレート２３）が水平方向に大きくならざるを得ない。そして、基板Ｗのサイズ（直径）が大型化すれば、それに応じて、熱処理面２２（熱プレート２３）の水平方向の直径を大きくしなければならない。そのため、熱処理部２０ｐの水平方向の面積が

の基板処理装置はランニングコストが高いクリーンルームに設置されるが、基板処理装置の設置面積が大型化すれば、それだけ、クリーンルームの床の利用効率が悪くなる。また、基板Wのサイズが大型化すれば、それに伴って熱処理部２０ｐの水平方向の面積が一層大きくなり、基板処理装置の設置面積は一層大きくならざるを得ない。

【００５４】これに対して、上記図８ないし図１１に示すような熱処理部２０では、基板Wを起立姿勢にし、熱処理面２２が起立姿勢を採るように熱プレート２３を配設して熱処理するように構成しているので、熱処理部２０の水平方向の面積をコンパクトにすることができる。さらに、基板Wのサイズが大型化し、熱処理面２２の直径を大きくしても、大きくなる方向は鉛直軸方向であり、水平方向への大型化はほとんど起きない。従って、このような熱処理部２０によれば、従来の熱処理部２０ｐに比べて水平方向の面積のコンパクト化が図れ、さらに、基板Wのサイズが大型化すればそれに比例して水平方向の面積のコンパクト化という効果は一層大きくなる。

【００５５】また、従来の熱処理部２０ｐでは、基板Wの受渡しのために昇降ピンＺＰが設けられているが、この昇降ピンＺＰは、熱プレート２３を貫通させなければならず、そのため、熱処理面２２（熱プレート２３）には昇降ピンＺＰが出退する孔（貫通孔）ＨＬが設けられている（図６、図７参照）。そのため、熱処理面２２全面での熱履歴を均一化させるのが難しく、その結果、基板W全面の熱履歴を均一化させるのは難しかった。

【００５６】これに対して、図８ないし図１１に示すような熱処理部２０によれば、熱処理面２２に孔などを設ける必要がなく、熱処理面２２全面での熱履歴を均一化させるのが容易であり、基板W全面の熱履歴を容易に均一化させることが可能である。さらに、基板Wを起立姿勢にして熱処理することにより、基板Wの鉛直軸方向の熱履歴が不均一になる場合には、起立姿勢の熱処理面２２に対して起立姿勢の基板Wを中心周りに回転させるようにしているので、基板W全面の熱履歴を均一にすることが可能となる。

【００５７】ここで、上記図８ないし図１１に示す熱処理部２０や基板搬送装置１などを備えた基板処理装置の構成の一例を図１３に示す。また、従来の熱処理部２０ｐや基板搬送装置１などを備えた基板処理装置の構成の一例を図１４に示す。

【００５８】これら基板処理装置は、熱処理部２０（加熱処理部２０ｈおよび冷却処理部２０ｃ）、あるいは、従来の熱処理部２０ｐ（加熱処理部２０ｈおよび冷却処理部２０ｃ）や、スピンコーターＳＣ、スピンデベロッパーＳＤなどの複数の基板処理部が配置される配置部Ｒ

【００５９】また、基板搬送装置１の上記レール２の配設方向（Ｙ軸方向）が、基板搬送路ＴＲの長手方向に一致されている。

【００６０】なお、図中の符号ＳＳは、スピンコーターＳＣやスピンデベロッパーＳＤに備えられるスピンチャックであり、図に示すように、スピンチャックＳＳに基板Wを水平姿勢で保持してレジスト塗布処理や現像処理を行うように構成されている。

【００６１】図１３と図１４とを比較しても明らかなように、従来の熱処理部２０ｐの水平方向の面積に比べて、改良された熱処理部２０の水平方向の面積の方が小さいので、基板処理装置全体の水平方向の面積、すなわち、基板処理装置の設置面積を小さくすることができる。

【００６２】なお、熱処理部に限らず、その他の基板処理部（スピンコーターＳＣやスピンデベロッパーＳＤなど）も基板Wを起立姿勢にして基板処理するように構成すれば、基板処理装置の設置面積の一層のコンパクト化を図ることができる。また、基板処理装置内の全ての基板処理部が基板Wを起立姿勢にして基板処理する構成であれば、基板搬送装置１は基板処理部間の移動や、各基板処理部に対する基板Wの受渡しを基板Wを常に起立姿勢状態に保持して行えるので、基板搬送装置１の構成や動作も簡略化できる。

【００６３】ところで、図１３などに示す基板処理装置では、配置部Ｒ１に配置されている基板処理部に対する基板Wの受渡しを行う場合と、配置部Ｒ２に配置されている基板処理部に対する基板Wの受渡しを行う場合とでは、図１５に示すように、基板搬送装置１の基板保持アーム１０の出退方向が反対方向となる。すなわち、基板搬送装置１のアーム支持台８を１８０° 旋回させる必要がある。

【００６４】ここで、基板処理部に対する基板Wの受渡しのための基板保持アーム１０の出退のストロークをＳＴとすると、基板保持アーム１０の出退方向であるアーム保持台８の長手方向の長さは前記ストロークＳＴよりも長く形成する必要がある。このアーム保持台８の長手方向の長さを（ＡＬ１＋ＡＬ２）とすると、アーム保持台８を前記軸５により１８０° 旋回させるためには、少なくとも前記アーム保持台８の長手方向の長さを構成するＡＬ１、ＡＬ２のうちの長い方の寸法を半径とする円よりも広い面積が必要になる。従って、図１６に示すように、基板搬送路ＴＲの幅Ｗ（基板搬送路ＴＲの短手方向の長さ）は、少なくとも前記ＡＬ１又はＡＬ２の長い方の寸法の２倍の長さ（ＡＬとする）以上の長さが必要である。

【００６５】そこで、例えば、図１７に示すように、基板処理装置を構成すれば図１３などの構成に比べて基板

ーム１０の出退方向を基板搬送路ＴＲの長手方向（Ｙ軸方向）に一致させた状態で、基板搬送装置１が基板搬送路ＴＲに沿って移動を行うように構成している（図の実線）。すなわち、図１に示す状態でレール２に沿った移動を行わせる。そして、基板搬送路ＴＲの長手方向（Ｙ軸方向）に対して、±θ（但し、θは０°以上９０°未満）だけアーム保持台８を旋回させた状態（図の二点鎖線）で、各基板処理部に対して基板Ｗの受渡しが行えるように、基板処理部（熱処理部２０やスピンコーターＳＣ、スピンデベロッパーＳＤなど）を基板処理装置の配置部Ｒ１、Ｒ２に配設している。

【００６７】このように構成すれば、図１８に示すように、アーム支持台８の長手方向が基板搬送路ＴＲに対して直交する状態を採る図１３などの構成に比べて、基板搬送路ＴＲの短手方向の長さを短くすることができる。すなわち、図１３などの構成の場合の基板搬送路ＴＲの短手方向の長さＷは、少なくともＡＬが必要である。これに対して、図１７の構成の場合の基板搬送路ＴＲの短手方向の長さＷＳは、少なくとも（（（ＡＬ／２）・ｓｉｎθ）×２）だけあればよい。なお、θが０°に近づけばそれだけＷＳが短くなり、基板搬送路ＴＲの短手方向の長さＷＳを短くすることができる。

【００６８】なお、図１７の構成において、スピンチャックＳＳへの基板Ｗの受渡しでは、起立姿勢の基板保持アーム１０がアーム保持台８に対して送りだしてから、スピンコーターＳＣまたはスピンデベロッパーＳＤ内で基板保持アーム１０を水平姿勢に姿勢転換するようにしている。

【００６９】また、図１７の構成では、熱処理部を図８ないし図１１で示す熱処理部２０で構成しているが、図６、図７に示す熱処理部２０ｐで構成してもよい。

【００７０】

【発明の効果】以上の説明から明らかなように、本発明によれば、基板を起立姿勢状態で保持して搬送するので、ダウンフローとともに降下されてくるパーティクルがあっても基板の処理面にパーティクルが付着し難くなった。また、ダウンフローとともに降下される熱雰囲気による基板の処理面への熱的影響も受け難くなった。さらに、基板を水平姿勢に保持して搬送するのに比べて、ダウンフローの気流の流されの妨げになり難くなった。また、従来装置のように基板を水平姿勢で搬送する場合に比べて、基板搬送路の水平方向の面積をコンパクトにすることも可能となり、基板処理装置全体の設置面積のコンパクト化を図ることも可能である。

【図面の簡単な説明】

【図１】本発明の一実施例に係る基板搬送装置の構成を示す斜視図である。

【図２】基板保持アームによる基板の保持状態と非保持状態とを示す要部側面図である。

【図３】基板保持アームが起立姿勢と水平姿勢とに姿勢転換された状態を示す要部正面図である。

【図４】基板を起立姿勢に保持して移動することによる効果を説明するための図である。

【図５】基板を起立姿勢に保持して移動することによる別の効果を説明するための図である。

【図６】従来の熱処理部の構成を示す斜視図である。

【図７】従来の熱処理部の一部省略正面図である。

【図８】改良された熱処理部の概略構成を示す正面図である。

【図９】図８のＡ－Ａ矢視図である。

【図１０】基板保持部材の構成を示す一部省略断面図であって、図９のＢ－Ｂ矢視断面図である。

【図１１】基板保持部材の開閉機構の一例の構成を示す図である。

【図１２】基板搬送装置と改良された熱処理部との基板の受渡し動作を説明するための図である。

【図１３】改良された熱処理部や基板搬送装置などを備えた基板処理装置の一例の構成を示す平断面図である。

【図１４】従来の熱処理部や基板搬送装置などを備えた基板処理装置の一例の構成を示す平断面図である。

【図１５】図１３などの基板処理装置における基板搬送装置の基板搬送アームの出退方向を示す図である。

【図１６】図１３などの基板処理装置の基板搬送路の短手方向の長さを示す図である。

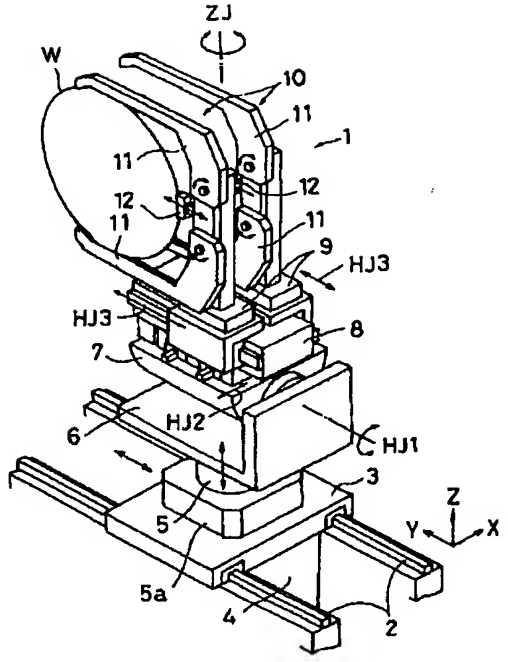
【図１７】基板搬送路の短手方向の長さを短くするための基板処理装置の一例の構成を示す平断面図である

【図１８】図１７の構成で基板搬送路の短手方向の長さが短くなることを説明するための図である。

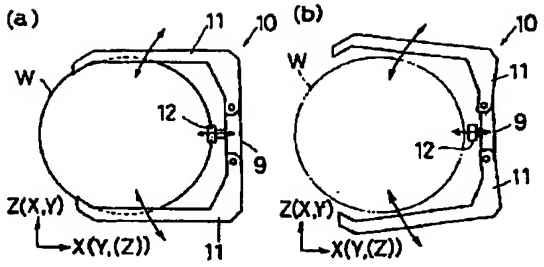
【符号の説明】

１　：基板搬送装置
２　：レール
３　：第１の台座
４　：旋回昇降機構
５　：軸
６　：第２の台座
７　：半円柱状部材
８　：アーム支持台
９　：アーム支持部
１０：基板保持アーム
１１：アーム部
１２：基板保持部
２０：熱処理部
ＳＣ：スピンコーター
ＳＤ：スピンデベロッパー
ＴＲ：基板搬送路
Ｗ　：基板

【図１】



【図２】



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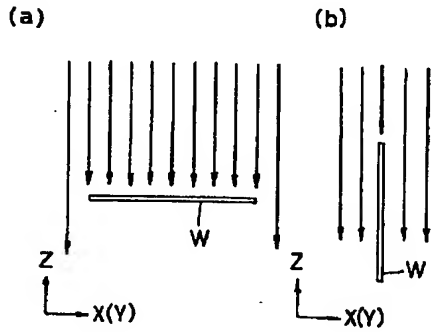

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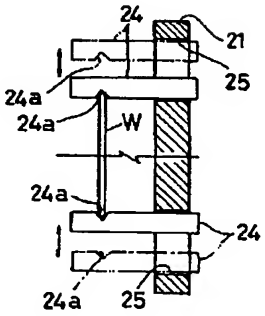

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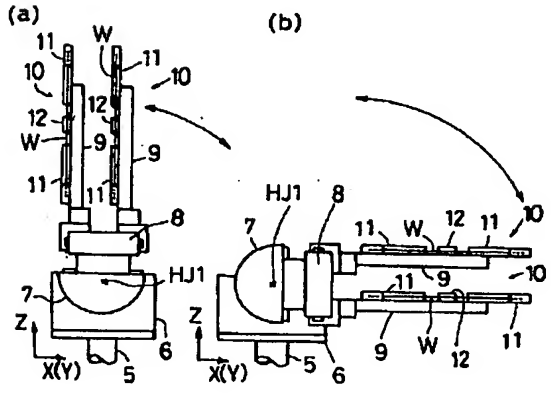

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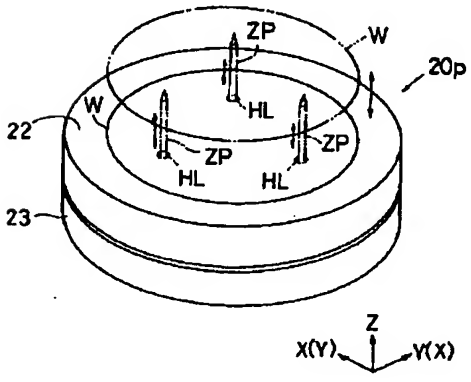

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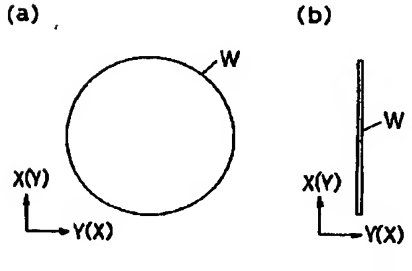

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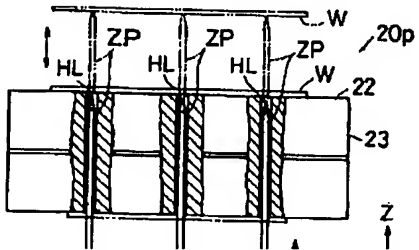

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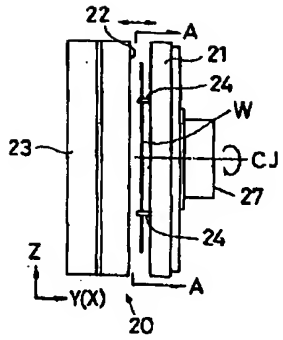

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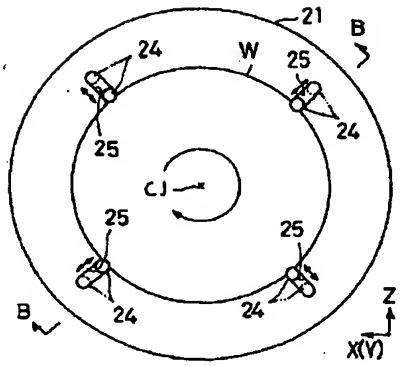
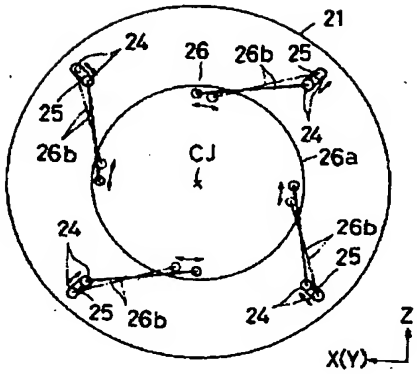


【図１１】



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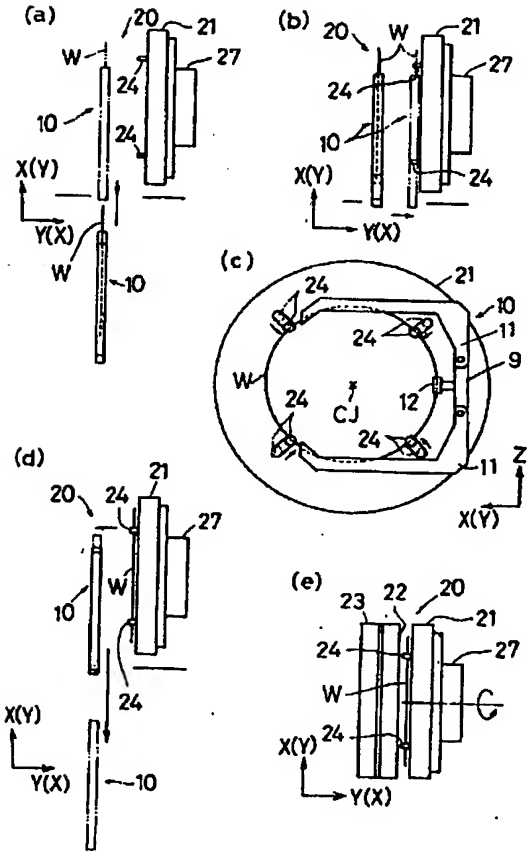

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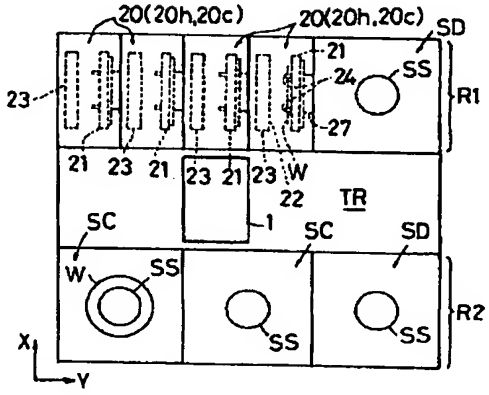

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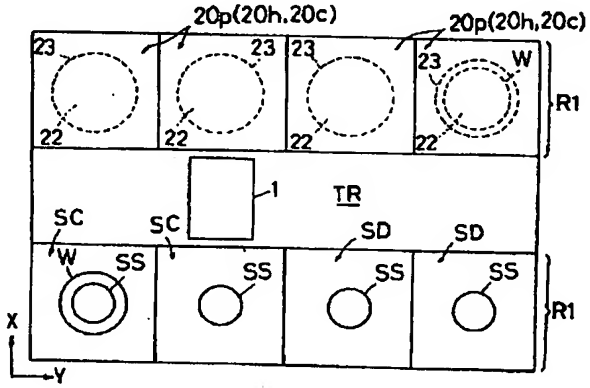

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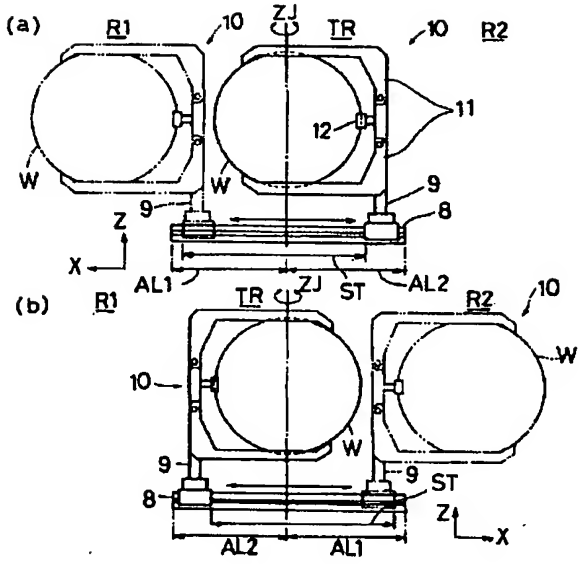

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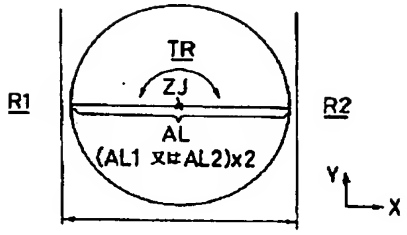

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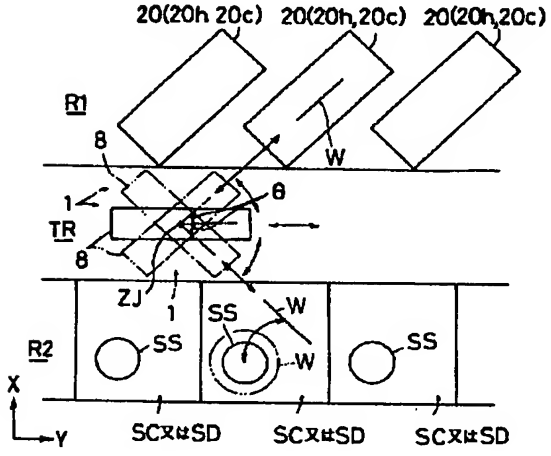
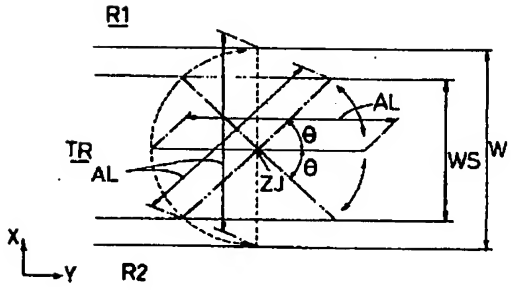


【図１８】



DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view showing the configuration of the substrate transport device concerning one example of this invention.
[Drawing 2] It is the important section side elevation showing the maintenance condition and the condition of not holding of a substrate by the substrate maintenance arm.
[Drawing 3] A substrate maintenance arm is the important section front view showing the condition that posture conversion was carried out in a standing-up posture and a horizontal position.
[Drawing 4] It is drawing for explaining the effectiveness by holding a substrate into a standing-up posture and moving.
[Drawing 5] It is drawing for explaining another effectiveness by holding a substrate into a standing-up posture and moving.
[Drawing 6] It is the perspective view showing the configuration of the conventional heat treatment section.
[Drawing 7] a part of conventional heat treatment section -- it is an abbreviation front view.
[Drawing 8] It is the front view showing the outline configuration of the improved heat treatment section.
[Drawing 9] It is the A-A view Fig. of drawing 8 .
[Drawing 10] the configuration of a substrate attachment component is shown -- it is an abbreviation sectional view a part and is the B-B view sectional view of drawing 9 .
[Drawing 11] It is drawing showing the configuration of an example of the breaker style of a substrate attachment component.
[Drawing 12] It is drawing for explaining delivery actuation of the substrate of a substrate transport device and the improved heat treatment section.
[Drawing 13] It is the plane section Fig. showing the configuration of an example of the substrate processor equipped with the improved heat treatment section, a substrate transport device, etc.
[Drawing 14] It is the plane section Fig. showing the configuration of an example of the substrate processor equipped with the conventional heat treatment section, a conventional substrate transport device, etc.
[Drawing 15] It is drawing showing the **** direction of the substrate conveyance arm of the substrate transport device in substrate processors, such as drawing 13 .
[Drawing 16] It is drawing showing the short hand lay length of the substrate conveyance way of substrate processors, such as drawing 13 .
[Drawing 17] It is the plane section Fig. showing the configuration of an example of the substrate processor for shortening short hand lay length of a substrate conveyance way.
[Drawing 18] It is drawing for explaining that the short hand lay length of a substrate conveyance way becomes short with the configuration of drawing 17 .
[Description of Notations]
1 : Substrate Transport Device
2 : Rail
3 : 1st Plinth
4 : Revolution Elevator Style
5 : Shaft
6 : 2nd Plinth
7 : Semicircle Pillar-shaped Member
8 : Arm Susceptor
9 : Arm Supporter
10: Substrate maintenance arm
11: Arm section
12: Substrate attaching part
20: Heat treatment section
SC: Spin coater
SD: Spin developer
TR: Substrate conveyance way
W : substrate

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] It has this invention in the substrate processor which has two or more substrate processing sections, and it relates to the substrate transport device which delivers the substrate to each substrate processing section while it holds a substrate and moves between each substrate processing section.
[0002]
[Description of the Prior Art] The substrate processors (photo lithography processor etc.) which have two or more substrate processing sections, such as for example, the heat treatment section (heat-treatment section and cooling processing section), a spin coater, and a spin developer, are equipped with this kind of substrate transport device, and it is constituted so that the substrate to each substrate processing section may be delivered, while holding a substrate and moving between each substrate processing section according to predetermined substrate procedure.
[0003] The conventional substrate transport device holds a substrate to a horizontal position, and is performing conveyances (migration between each substrate processing section, delivery of a substrate to each substrate processing section, etc.) of the substrate within a substrate processor.
[0004]
[Problem(s) to be Solved by the Invention] However, in the case of the conventional example which has such a configuration, there are the following problems. the substrate conveyance way where a substrate transport device conveys a substrate in this kind of substrate processor -- particle -- soaring -- etc. -- in order to control, the air current of a downflow is passed from the equipment upper part to the equipment lower part. However, if a substrate is held to a horizontal position and conveyance of a substrate is performed, the air current of a downflow will be equivalent to the top face (usually processing side) of a substrate directly. Therefore, there was a problem that the particle which flows down with the air current of a downflow tends to adhere to the processing side of a substrate.
[0005] Moreover, there was also a problem of being easy to have thermal effect according to the heat ambient atmosphere which flows down with the air current of the above-mentioned downflow on the processing side of a substrate.
[0006] Furthermore, when holding the substrate to the horizontal position and performing conveyance of a substrate, it had also become the factor which checks the flow of the air current of the above-mentioned downflow.
[0007] This invention is made in view of such a situation, and aims at offering the substrate transport device which can mitigate the bad influence to the substrate at the time of substrate conveyance etc.
[0008]
[Means for Solving the Problem] This invention takes the following configurations, in order to attain such a purpose. Namely, while having this invention in the substrate processor which has two or more substrate processing sections, holding a substrate and moving between each substrate processing section The substrate maintenance arm which can hold a substrate in the state of a standing-up posture condition and a horizontal position in the substrate transport device which delivers the substrate to each substrate processing section, A posture conversion means to carry out posture conversion of said substrate maintenance arm by the standing-up posture and the horizontal position, Through said substrate maintenance arm, the substrate to each substrate processing section is delivered, and substrate delivery is carried out. A means, It has the migration means to which said substrate maintenance arm is moved between each substrate processing section, and is characterized by holding a substrate in the standing-up posture condition, and performing migration between each substrate processing section at least.
[0009]
[Function] The operation of this invention is as follows. A substrate is held during substrate conveyance at a substrate maintenance arm. And posture conversion is carried out and a substrate maintenance arm changes the substrate currently held into a standing-up posture condition into a standing-up posture. A substrate maintenance arm is moved by the migration means in this condition, and migration of the substrate between each substrate processing section is performed. That is, a substrate is held at a standing-up posture condition, and is moved between each substrate processing section.
[0010] Moreover, although delivery of the substrate between the substrates and the substrate processing sections which carried out substrate delivery and were held by the means at the substrate maintenance means is performed, delivery of a substrate to the substrate processing section which carries out substrate processing of the substrate by the horizontal position is performed with a posture conversion means by carrying out posture conversion of the substrate maintenance arm at a horizontal position. Moreover, still in the state at the time of migration of a substrate, delivery of a substrate to the substrate processing section which carries out substrate processing of the substrate with a standing-up posture is performed, where a substrate maintenance arm is made into a standing-up posture.
[0011] In addition, the standing-up posture of a substrate means the posture in which the processing side of a substrate becomes parallel to the direction of a vertical axis, and the horizontal position of a substrate means the posture in which the processing side of a substrate becomes horizontally parallel. Moreover, the standing-up posture of a substrate maintenance arm means the posture in which a substrate is held in the state of a standing-up posture, and the horizontal position of a substrate maintenance arm means the posture in which a substrate is held in the state of a horizontal position.
[0012]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing. Drawing 1 is the perspective view showing the configuration of the substrate transport device concerning one example of this invention, and the important section side elevation and drawing 3 which show the maintenance condition and the condition of not holding of a substrate according [drawing 2] to a substrate maintenance arm are an important section front view with which a substrate maintenance arm shows the condition that posture conversion was carried out to a standing-up posture and a horizontal position. In addition, in order to clarify physical relationship of each drawing, the XYZ rectangular coordinate system is given to the proper drawing below drawing 1 . Moreover, in this XYZ rectangular coordinate system, the X-axis and a Y-axis are horizontal orthogonal axes (XY flat surface is a horizontal plane), and the Z-axis is a vertical axis.
[0013] This substrate transport device 1 is constituted as follows. It is constituted so that the 1st plinth 3 may be moved to horizontal 1 shaft orientations (drawing Y shaft orientations) along with the rail 2 of the pair arranged in the direction of a Y-axis (the X-axis is sufficient) of drawing which is horizontal 1 shaft orientations.
[0014] The revolution elevator style 4 is attached in the lower part of the 1st plinth 3. The revolution elevator style 4 is moved along with a rail 2 with the 1st plinth 3. While rise-and-fall section 5a which penetrated the 1st plinth 3 goes up and down by this revolution elevator style 4 (from the 1st plinth 3 to ****), the shaft 5 projected free [rotation] from rise-and-fall section 5a rotates to the circumference of ZJ shaft (in addition, ZJ shaft is a shaft which is in agreement with the medial axis of a shaft 5) of drawing which is a vertical axis (revolution). In addition, the revolution elevator style 4 makes it circle in a shaft 5 by rotation of the motor which was installed inside rise-and-fall section 5a and which is not

illustrated, and it is constituted so that you may make it go up and down with 1 shaft-orientations drive (not shown) of common knowledge of the rise-and-fall section 5a, such as a ball screw.

[0015] The 2nd plinth 6 is attached in the upper limit section of a shaft 5. It is attached in this 2nd plinth 6 so that it may rotate to the circumference of horizontal 1 shaft (HJ1 shaft of drawing) by the motor which the semicircle column-like member 7 does not illustrate. It is attached in the direction of horizontal 1 shaft (HJ biaxial of drawing) in which said HJ1 shaft and the arm susceptor 8 cross at right angles at this semicircle pillar-shaped member 7 so that minute migration can be carried out.

[0016] The two arm supporter 9 is moved in the direction parallel to said HJ1 shaft of horizontal 1 shaft (HJ3 shaft of drawing) according to an individual at the arm susceptor 8 (it is **** to the arm susceptor 8).

[0017] The substrate maintenance arm 10 is formed in each arm supporter 9. Each substrate maintenance arm 10 is equipped with the arm member 11 of the pair constituted free [closing motion], and the substrate attaching part 12 constituted free [****]. While the slot which is not illustrated is engraved on each arm member 11 and the substrate attaching part 12 and each arm member 11 is closed, where the substrate attaching part 12 is projected, Substrate W is held in the slot of said each arm member 11 and the substrate attaching part 12 (drawing 2 (a)). On the other hand, while each arm member 11 is opened, after the substrate attaching part 12 has retreated, the maintenance condition of Substrate W is canceled (drawing 2 (b)).

[0018] By moving the 1st plinth 3 along with a rail 2, the substrate maintenance arm 10 is moved in the direction of horizontal 1 shaft (Y-axis). Moreover, when rise-and-fall section 5a goes up and down to the 1st plinth 3, the substrate maintenance arm 10 goes up and down. Furthermore, when a shaft 5 circles to the circumference of ZJ shaft, ****** of the substrate maintenance arm 10 to the arm maintenance base 8 come out of and removed is changed. The substrate maintenance arm 10 is moved by these actuation among two or more substrate processing sections installed in a substrate processor.

[0019] Moreover, when the semicircle pillar-shaped member 7 rotates to the circumference of HJ1 shaft to the 2nd plinth 6, posture conversion of the substrate maintenance arm 10 is carried out between a standing-up posture (posture in which Substrate W is held in the state of a standing-up posture), and a horizontal position (posture in which Substrate W is held in the state of a horizontal position) (refer to drawing 1 and drawing 3).

[0020] Furthermore, delivery of Substrate W to each substrate processing section is performed by **** actuation of the substrate maintenance arm 10 to the arm maintenance base 8, minute migration of the HJ biaxial direction of the arm susceptor 8 to the semicircle pillar-shaped member 7, and maintenance of the substrate W by the substrate maintenance arm 10 and actuation of the discharge.

[0021] This substrate transport device 1 makes the substrate maintenance arm 10 a standing-up posture for migration between the substrate processing sections, holds Substrate W in the standing-up posture condition, and performs it.

[0022] Moreover, although substrate processing in each substrate processing section installed in the substrate processor with which it has this substrate transport device 1 is generally conventionally performed by holding Substrate W to a horizontal position According to this substrate transport device 1, the delivery of Substrate W to the substrate processing section which holds Substrate W to a horizontal position and carries out substrate processing performs posture conversion with the standing-up posture of the substrate maintenance arm 10, and a horizontal position, and the substrate maintenance arm 10 can be made into a horizontal position, and can be performed.

[0023] Moreover, still in the state at the time of migration of Substrate W, the substrate maintenance arm 10 can be made into a standing-up posture, and the delivery of Substrate W to the substrate processing section which holds Substrate W into a standing-up posture, and carries out substrate processing can perform it.

[0024] particle [in / a substrate conveyance way etc. / in the substrate conveyance way (circulation space to which the substrate transport device 1 performs conveyance of Substrate W etc.) of this kind of substrate processor, an air current is passed from the equipment upper part by the downflow to an equipment lower part, and] -- soaring -- etc. -- he is trying to control

[0025] For example, the particle which flows down migration of the substrate W in a substrate conveyance way etc. with the air current of a downflow shown in the top face (a processing side is usually used as a top face, and substrate conveyance is carried out) of a substrate by the arrow head as it is shown in drawing 4 (a), when Substrate W is made into a horizontal position and performed becomes easy to adhere like equipment before. Moreover, since the heat ambient atmosphere will be responded to like adhesion of the above-mentioned particle on the top face (processing side) of the substrate W of a horizontal position when the heat ambient atmosphere emitted above the substrate conveyance way from the heat-treatment section descends with the air current of a downflow, it is [thermal] easy to be influenced of the processing side on Substrate W. Furthermore, if Substrate W is a horizontal position, since the air current of a downflow will be responded to on the top face of Substrate W, it also becomes the hindrance of the air current of a downflow (refer to drawing 4 (a)).

[0026] On the other hand, since Substrate W is held in the state of a standing-up posture and migration in a substrate conveyance way etc. is performed, as shown in drawing 4 (b), adhesion of the particle to the processing side of Substrate W cannot occur easily, and it is hard coming to win popularity thermal effect in the substrate transport device 1 concerning this invention. Furthermore, Substrate W cannot become the hindrance of the air current of a downflow easily (refer to drawing 4 (b)) for it to be a standing-up posture, either.

[0027] Moreover, as shown in drawing 5 , in case migration of Substrate W etc. is performed on a substrate conveyance way, the projected area of Substrate W becomes [the direction which looks at by plane view and is performed with a standing-up posture] small by the case (drawing 5 (a)) where make Substrate W into a horizontal position and it is performed like before, and the case (drawing 5 (b)) where it carries out by making it a standing-up posture like this invention. Therefore, by making Substrate W into a standing-up posture, and performing migration of Substrate W etc., it also becomes possible to attain miniaturization of a horizontal area of a substrate conveyance way, and it also becomes possible to attain miniaturization of the installation area of a substrate processor.

[0028] By the way, conventionally, as mentioned above, generally the substrate processing section in a substrate processor is constituted so that Substrate W may be held to a horizontal position and substrate processing may be carried out. For example, the heat treatment section (heat-treatment section, cooling processing section) which is one of the substrate processing sections installed in the photo lithography processor which is one of the substrate processors is constituted as conventionally shown in drawing 6 and drawing 7 .

[0029] That is, the heat plate 23 is arranged by the conventional heat treatment section 20p so that the heat treatment side 22 of the heat plate (the heat-treatment section a heating plate and the cooling processing section cooling plate) 23 may be horizontally in agreement. And to the heat treatment side 22, contact installation is carried out, or Substrate W separates minute spacing (pro squeak tee gap), contiguity support is carried out and heat treatment is performed. That is, as for Substrate W, heat treatment is performed by the horizontal position.

[0030] In addition, delivery of the substrate W in the conventional heat treatment section 20p is constituted so that it may be carried out using two or more rise-and-fall pins ZP which penetrated the heat plate 23 and were generally prepared free [rise and fall]. That is, as the two-dot chain line of drawing shows, delivery of Substrate W is performed in the delivery location where two or more rise-and-fall pins ZP projected from the heat plate 23, and Substrate W was supported by the heat plate 23 upper part.

[0031] Although the conventional substrate transport device holds Substrate W to a horizontal position and migration etc. is performed, the substrate transport device 1 concerning the above-mentioned example holds Substrate W (substrate maintenance arm 10) into a standing-up posture, and is made to perform migration etc. Therefore, in addition to delivery actuation of the substrate W by the conventional substrate transport device, at the delivery of Substrate W to heat treatment section 20p shown in drawing 6 and drawing 7 , the actuation which carries out posture conversion of the substrate maintenance arm 10 between a standing-up posture and a horizontal position is needed.

[0032] For example, in handing over the substrate W held at the substrate maintenance arm 10 of the substrate transport device 1 at the rise-and-fall pin ZP, it carries out posture conversion of the substrate maintenance arm 10 of a standing-up posture at a horizontal position. And the substrate maintenance arm 10 is sent out to the arm maintenance base 8, Substrate W is located in the delivery location of the heat plate 23 upper part in a horizontal position condition, and Substrate W is handed over at the rise-and-fall pin ZP. The post turnover of Substrate W and the substrate maintenance arm 10 are retreated, and posture conversion of the substrate maintenance arm 10 of a horizontal position is carried out at a standing-up posture.

[0033] Moreover, when the substrate maintenance arm 10 of the substrate transport device 1 receives Substrate W from the rise-and-fall pin ZP, posture conversion of the substrate maintenance arm 10 of a standing-up posture is carried out at a horizontal position, the substrate maintenance arm 10 is sent out to the arm maintenance base 8, and the substrate maintenance arm 10 of a horizontal position receives the substrate W of a horizontal position from the rise-and-fall pin ZP in the delivery location of the heat plate 23 upper part. And the substrate maintenance arm 10 holding Substrate W is retreated, and posture conversion of the substrate maintenance arm 10 of a horizontal position is carried out at a standing-up posture.
[0034] In addition, although Substrate W is held to a spin chuck by the horizontal position and resist spreading processing, a development, etc. are performed to it by the spin coater and spin developer who are the other substrate processing sections, delivery of the substrate W between this spin chuck and the substrate maintenance arm 10 as well as the above-mentioned heat treatment section 20p is performed where the substrate maintenance arm 10 is made into a horizontal position.
[0035] Here, if it constitutes so that it may carry out by holding substrate processing in the substrate processing section, and holding Substrate W with a standing-up posture, Substrate W can be delivered where the substrate maintenance arm 10 is made into a standing-up posture.
[0036] For example, if the heat treatment section is constituted as shown in drawing 8 thru/or drawing 11 , Substrate W can be delivered where the substrate maintenance arm 10 is made into a standing-up posture.
[0037] Drawing 8 is the front view showing the outline configuration of the improved heat treatment section, it is an abbreviation sectional view a part and the B-B view sectional view of drawing 9 and drawing 11 are drawings in which drawing 9 shows the A-A view Fig. of drawing 8 , and drawing 10 shows the configuration of a substrate attachment component and in which showing the configuration of an example of the breaker style of a substrate attachment component.
[0038] This heat treatment section 20 is equipped with the substrate maintenance base 21 which holds Substrate W with a standing-up posture, and the heat plate 23 which has the heat treatment side 22 which counters the substrate W held on the substrate maintenance base 21, and is constituted.
[0039] Three or more (drawing four pieces) substrate attachment components 24 for holding at least three or more (drawing four places) places of the periphery edge of Substrate W are formed in the substrate maintenance base 21. Each substrate attachment component 24 is constituted so that the maintenance condition of opening and closing in the direction shown in the arrow head of drawing along with a long hole 25, contacting the periphery edge of Substrate W, and holding Substrate W, and the condition of separating from the periphery edge of Substrate W and canceling maintenance of Substrate W and of not holding can be taken. In addition, notching 24a is prepared in each substrate attachment component 24, and Substrate W is held by this notching 24a in the above-mentioned maintenance condition (refer to drawing 10).
[0040] The breaker style which makes each substrate attachment component 24 open and close is realizable by devices, such as the link mechanism 26 shown in drawing 11 . By the device of drawing 11 , disc-like member 26a is supported free [the rotation to the circumference of CJ shaft] at the rear-face (field [of the side holding Substrate W], and field of the opposite side) side of the substrate maintenance base 21. Each substrate attachment component 24 and disc-like member 26a are connected by arm member 26b. It connects with the end face section of each substrate attachment component 24 free [rotation], and the other end side is connected with it by the end section side of each arm member 26b free [rotation] at the periphery edge of disc-like member 26a. And each arm member 26b displaces between the continuous lines and two-dot chain lines of drawing, and each substrate attachment component 24 is opened by driving by the air cylinder which is not illustrated and predetermined include-angle rotation of the disc-like member 26a being carried out at the circumference of CJ shaft and closed along with a long hole 25.
[0041] Moreover, the substrate maintenance base 21 rotates to the circumference of CJ shaft by the motor 27. The above-mentioned CJ shaft is a shaft which penetrates the core of the substrate W held on the substrate maintenance base 21, and the substrate W held on the substrate maintenance base 21 by rotation of the circumference of CJ shaft of the above-mentioned substrate maintenance base 21 rotates it to the circumference of a core.
[0042] In addition, if Substrate W is heat-treated with a standing-up posture, since the heat history of a substrate may be changed in the direction of a vertical axis, for example, he is trying to rotate Substrate W to the circumference of a core, in order to prevent such un-arranging, but a motor 27 etc. may be omitted when fluctuation of the heat history of the direction of a vertical axis of Substrate W is reliable.
[0043] When the heat treatment section 20 is the heat-treatment section, the heater which is not illustrated is installed inside by the heat plate (heating plate) 23, and the heat treatment side 22 is heated, and it is constituted so that it may heat-treat to the substrate W held on the substrate maintenance base 21. Moreover, when the heat treatment section 20 is the cooling processing section, the Peltier device which is not illustrated is installed inside by the heat plate (cooling plate) 23, and the heat treatment side 22 is cooled, and it is constituted so that cooling processing may be performed to the substrate W held on the substrate maintenance base 21. This heat plate 23 is arranged with the standing-up posture so that the heat treatment side 22 may counter the substrate W held on the substrate maintenance base 21.
[0044] In addition, in order to make easy to deliver the substrate W with the substrate transport device 1, the substrate maintenance base 21 and the heat plate 23 are constituted by well-known 1 shaft-orientations drives (not shown), such as a ball screw and an air cylinder, so that it may attach and detach relatively. And at the time of delivery of Substrate W, the substrate maintenance base 21 and the heat plate 23 are estranged relatively, and the substrate maintenance base 21 and the heat plate 23 approach relatively at the time of heat treatment.
[0045] Next, delivery of the substrate W between the substrate maintenance base 21 of this heat treatment section 20 and the substrate maintenance arm 10 of the substrate transport device 1 is explained.
[0046] The substrate W which the substrate maintenance arm 10 holds is explained with reference to drawing 12 about the case where it hands over on the substrate maintenance base 21.
[0047] Deliver the substrate maintenance arm 10, it is made to move before the target heat treatment section 20 by the migration and rise-and-fall actuation which met the rail 2, and the **** direction of the <TXF FR=0002 HE=250 WI=080 LX=1100 LY=0300> substrate maintenance arm 10 to the arm maintenance base 8 is adjusted to the heat treatment section 20 side by revolution of a shaft 5. And the substrate maintenance arm 10 of a standing-up posture is sent out to the arm maintenance base 8 (drawing 12 (a)).
[0048] Next, the minute migration of the arm susceptor 8 is made to carry out in the HJ biaxial direction (right of drawing), and Substrate W is located in the location where the substrate attachment component 24 of the substrate maintenance base 21 can hold Substrate W (drawing 12 (b)). At this time, the substrate attachment component 24 of the substrate maintenance base 21 is open. And if Substrate W is located in the location where the substrate attachment component 24 can hold Substrate W by the above-mentioned actuation, the substrate attachment component 24 will be closed and the substrate maintenance base 21 side will also hold Substrate W (drawing 12 (c)).
[0049] And after making maintenance of the substrate W by the substrate maintenance arm 10 cancel, changing into the condition of making the minute migration of the arm susceptor 8 carrying out in the HJ biaxial direction (left of drawing), and avoiding interference with the substrate maintenance arm 10 and the substrate attachment component 24 and closing the arm member 11, the substrate maintenance arm 10 is retreated (drawing 12 (d)). Thereby, while the substrate maintenance arm 10 has been a standing-up posture, Substrate W can be handed over on the substrate maintenance base 21 from the substrate maintenance arm 10.
[0050] In the heat treatment section 20, if Substrate W is received, the substrate maintenance base 21 and the heat plate 23 holding Substrate W will approach relatively, will carry out contiguity arrangement of Substrate W and the heat treatment side 22, and will heat-treat to Substrate W. In changing the heat history of the direction of a vertical axis of Substrate W at this time, the substrate maintenance base 21 is rotated to the circumference of CJ shaft, and it heat-treats by rotating Substrate W to the circumference of a core to the heat treatment side 22 (drawing 12 (e)).

[0051] moreover, the case where the substrate W currently held on the substrate maintenance base 21 is taken out with the substrate maintenance arm 10 -- the above-mentioned actuation and abbreviation -- it can carry out in reverse actuation.
[0052] Thus, the substrate W between the substrate maintenance arm 10 and the substrate processing section can be delivered with constituting the substrate processing section, making the substrate maintenance arm 10 into a standing-up posture so that Substrate W may be held into a

standing-up posture and substrate processing may be carried out, and posture conversion of the substrate maintenance arm 10 of a standing-up posture is carried out at a horizontal position, or it becomes that it is unnecessary to a standing-up posture in the actuation which carries out posture conversion about the substrate maintenance arm 10 of a horizontal position. Moreover, since delivery of Substrate W also holds Substrate W in the standing-up posture condition and performs it, adhesion, thermal effect, etc. of particle of the processing side on Substrate W are mitigable at the time of delivery of Substrate W.

[0053] By the way, generally, the heat treatment side 22 of the heat plate 23 is constituted so that the diameter may become larger than the diameter of Substrate W. Therefore, in the conventional heat treatment section 20p, since it is the configuration which makes Substrate W a horizontal position and heat-treats it, the heat treatment side 22 (heat plate 23) cannot but become large horizontally. And if the size (diameter) of Substrate W is enlarged, according to it, the horizontal diameter of the heat treatment side 22 (heat plate 23) must be enlarged. Therefore, enlargement of the installation area of the substrate processor with which a horizontal area of heat treatment section 20p becomes large, consequently heat treatment section 20p is installed is not avoided. Although this kind of substrate processor is installed in the clean room where a running cost is high, if the installation area of a substrate processor is enlarged, the use effectiveness of the floor of a clean room will worsen so much. Moreover, if the size of Substrate W is enlarged, in connection with it, a horizontal area of heat treatment section 20p cannot but become still larger, and the installation area of a substrate processor cannot but become still larger.

[0054] On the other hand, since it constitutes from the heat treatment section 20 as shown in above-mentioned drawing 8 thru/or drawing 11 so that Substrate W may be made into a standing-up posture, the heat treatment side 22 may take a standing-up posture, and the heat plate 23 may be arranged and heat-treated, horizontal area of the heat treatment section 20 can be used as a compact. Furthermore, even if the size of Substrate W is enlarged and it enlarges the diameter of the heat treatment side 22, the direction which becomes large is the direction of a vertical axis, and the enlargement to a horizontal direction hardly occurs. Therefore, according to such the heat treatment section 20, miniaturization of a horizontal area can be attained compared with the conventional heat treatment section 20p, and further, if the size of Substrate W is enlarged, in proportion to it, the effectiveness of miniaturization of a horizontal area will become still larger.

[0055] Moreover, in the conventional heat treatment section 20p, although the rise-and-fall pin ZP is formed for delivery of Substrate W, this rise-and-fall pin ZP must make the heat plate 23 penetrate, therefore removed **** (through tube) HL out of which the rise-and-fall pin ZP comes is formed in the heat treatment side 22 (heat plate 23) (refer to drawing 6 and drawing 7). Therefore, it was difficult to have made the heat history in the heat treatment side 22 whole surface equalize, consequently it was difficult to have made the heat history of the whole substrate W surface equalize.

[0056] On the other hand, according to the heat treatment section 20 as shown in drawing 8 thru/or drawing 11 , it is easy for it not to be necessary to prepare a hole etc. in the heat treatment side 22, and to make the heat history in the heat treatment side 22 whole surface equalize, and it is possible to make the heat history of the whole substrate W surface equalize easily. Furthermore, since he is trying to rotate the substrate W of a standing-up posture to the circumference of a core to the heat treatment side 22 of a standing-up posture when the heat history of the direction of a vertical axis of Substrate W becomes an ununiformity by making Substrate W into a standing-up posture, and heat-treating it, it becomes possible to make the heat history of the whole substrate W surface into homogeneity.

[0057] Here, an example of the configuration of the substrate processor equipped with the heat treatment section 20 shown in above-mentioned drawing 8 thru/or drawing 11 , the substrate transport device 1, etc. is shown in drawing 13 . Moreover, an example of the configuration of the substrate processor equipped with the conventional heat treatment section 20p, the substrate transport device 1, etc. is shown in drawing 14 .

[0058] The arrangement sections R1 and R2 by which the substrate processing section of plurality [processor / these / substrates], such as the heat treatment section 20 (h [of heat-treatment sections / 20], cooling processing section 20c) or conventional heat treatment section 20p (20h of heat-treatment sections, cooling processing section 20c), and a spin coater SC, the spin developer SD, is arranged are formed across the substrate conveyance way TR of the substrate transport device 1.

[0059] Moreover, the arrangement direction (Y shaft orientations) of the above-mentioned rail 2 of the substrate transport device 1 is in agreement with the longitudinal direction of the substrate conveyance way TR.

[0060] In addition, the sign SS in drawing is a spin chuck with which a spin coater SC and the spin developer SD are equipped, and as shown in drawing, it holds Substrate W by the horizontal position to a spin chuck SS, and it is constituted so that resist spreading processing and a development may be performed.

[0061] Since the horizontal area of the improved heat treatment section 20 is smaller compared with a horizontal area of the conventional heat treatment section 20p so that clearly even if it compares drawing 13 with drawing 14 , a horizontal area of the whole substrate processor, i.e., the installation area of a substrate processor, can be made small.

[0062] In addition, if it constitutes so that not only the heat treatment section but the other substrate processing sections (a spin coater SC, spin developer SD, etc.) may make Substrate W a standing-up posture and may carry out substrate processing, much more miniaturization of the installation area of a substrate processor can be attained. Moreover, all the substrate processing sections in a substrate processor make Substrate W a standing-up posture, and if it is the configuration which carries out substrate processing, since the substrate transport device 1 always holds Substrate W in the standing-up posture condition and can perform migration between the substrate processing sections, and delivery of Substrate W to each substrate processing section, the configuration and actuation of the substrate transport device 1 can also be simplified.

[0063] By the way, with the substrate processor shown in drawing 13 etc., by the case where the substrate W to the substrate processing section arranged at the arrangement section R1 is delivered, and the case where the substrate W to the substrate processing section arranged at the arrangement section R2 is delivered, as shown in drawing 15 , the **** direction of the substrate maintenance arm 10 of the substrate transport device 1 turns into an opposite direction. That is, it is necessary to make it circle in 180 degrees of arm susceptors 8 of the substrate transport device 1.

[0064] If the stroke of **** of the substrate maintenance arm 10 for the delivery of Substrate W to the substrate processing section is set to ST here, it is necessary to form the die length of the longitudinal direction of the arm maintenance base 8 which is the **** direction of the substrate maintenance arm 10 for a long time than said stroke ST. When the die length of the longitudinal direction of this arm maintenance base 8 is set to (AL1+AL2), in order to make it circle in 180 degrees of arm maintenance bases 8 with said shaft 5, an area larger than the circle which makes a radius the dimension of the longer one of the AL1 and AL2 which constitute the die length of the longitudinal direction of said arm maintenance base 8 at least is needed. Therefore, as shown in drawing 16 , the die length more than a dimension (referred to as AL) twice the die length of the longer one of said AL1 or AL2 is required for the width of face W of the substrate conveyance way TR (short hand lay length of the substrate conveyance way TR) at least.

[0065] If a substrate processor is constituted as shown in drawing 17 , compared with the configuration of drawing 13 etc., width of face of the substrate conveyance way TR can be shortened there.

[0066] It constitutes from drawing 17 so that the substrate transport device 1 may move along the substrate conveyance way TR in the condition of having made the **** direction of the substrate maintenance arm 10 of the substrate transport device 1 in agreement with the longitudinal direction (Y shaft orientations) of the substrate conveyance way TR (continuous line of drawing). That is, the migration which met the rail 2 in the condition which shows in drawing 1 is made to perform. And to the longitudinal direction (Y shaft orientations) of the substrate conveyance way TR, it is in the condition (two-dot chain line of drawing) that only **theta (however, theta 0 degrees or more less than 90 degrees) made it circle in the arm maintenance base 8, and the substrate processing sections (the heat treatment section 20, a spin coater SC, the spin developer SD, etc.) are arranged in the arrangement sections R1 and R2 of a substrate processor so that Substrate W can be delivered to each substrate processing section.

[0067] Thus, if constituted, as shown in drawing 18 , the longitudinal direction of the arm susceptor 8 can shorten short hand lay length of the substrate conveyance way TR compared with the configuration of drawing 13 which takes the condition of intersecting perpendicularly to the substrate conveyance way TR. That is, AL is required for short hand lay length W of the substrate conveyance way TR in configurations, such as drawing 13 , at least. On the other hand, even if there is little short hand lay length WS of the substrate conveyance way TR in the configuration

of drawing 17 , it should have only ((AL/2) (-sintheta) x2). In addition, if theta approaches 0 degree, so much, WS becomes short and can shorten short hand lay length WS of the substrate conveyance way TR.

[0068] In addition, in the configuration of drawing 17 , at delivery of the substrate W to a spin chuck SS, after the substrate maintenance arm 10 of a standing-up posture sends out to the arm maintenance base 8, it is made to carry out posture conversion of the substrate maintenance arm 10 within a spin coater SC or the spin developer SD at a horizontal position.

[0069] Moreover, although the configuration of drawing 17 constitutes the heat treatment section from the heat treatment section 20 shown by drawing 8 thru/or drawing 11 , you may constitute from heat treatment section 20p shown in drawing 6 and drawing 7 .

[0070]

[Effect of the Invention] Since according to this invention a substrate was held in the state of a standing-up posture and conveyed so that clearly from the above explanation, even if there was particle which descends with a downflow, particle stopped being able to adhere to the processing side of a substrate easily. Moreover, it was hard coming to win popularity the thermal effect of the processing side on the substrate by the heat ambient atmosphere which descends with a downflow. Furthermore, compared with holding and conveying a substrate to a horizontal position, it was hard coming to become the hindrance of ****** of the air current of a downflow. Moreover, compared with the case where a substrate is conveyed by the horizontal position like equipment before, it is also possible to also use horizontal area of a substrate conveyance way as a compact and to become possible and to attain miniaturization of the installation area of the whole substrate processor.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] While having in the substrate processor which has two or more substrate processing sections, holding a substrate and moving between each substrate processing section The substrate maintenance arm which can hold a substrate in the state of a standing-up posture condition and a horizontal position in the substrate transport device which delivers the substrate to each substrate processing section, A posture conversion means to carry out posture conversion of said substrate maintenance arm by the standing-up posture and the horizontal position, Through said substrate maintenance arm, the substrate to each substrate processing section is delivered, and substrate delivery is carried out. A means, The substrate transport device characterized by having the migration means to which said substrate maintenance arm is moved between each substrate processing section, holding a substrate in the standing-up posture condition, and performing migration between each substrate processing section at least.

[Translation done.]